DOCUMENT RESUME

ED 115 301 IR 002 851

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TITLE The Structure of TV Pictures: The Forces That Operate Within the TV Screen.
PUB DATE Nov 75
NOTE 26p.; Paper presented at the Annual Meeting of the National Association of Educational Broadcasters (Washington, D.C., November 15-19, 1975)

EDRS PRICE MF-$0.76 HC-$1.95 Plus Postage
DESCRIPTORS Contrast; Production Techniques; *Research Needs; *Television; Television Lighting; *Television Research; *Visual Perception

ABSTRACT

Little research has been conducted into the structure of television images. This structure merits examination in terms of its perceptual psychology, composition (light, color, form, placement, sound, and editing), and the aesthetics of motio Field forces theory asserts that there are differences between a real scenario and its representation on television and that these differences should be analyzed in terms of orientation, aspect ratio, direction of movement, symmetry, proportion, and balance. Several key questions of perception demand further research: (1) placement within the television field; (2) boundaries of the screen; and (3) the contrast between the subject and its background. The results of future research could profoundly affect techniques in lighting, staging, and space manipulation. (EMH)

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THE STRUCTURE OF TV PICTURES:

THE FORCES THAT OPERATE WITHIN THE TV SCREEN

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November, 1975

IR002 851

INTRODUCTION

With the growing dependence on television as a desseminator of information, research needs to determine the most efficient and effective means of visual and oral presentation possible. Such research must be based on the studies and findings of (a) visual and auditory perception, (b) composition, and (c) the aesthetics of the moving image, to mention only the most important.

Some movement in this direction has taken place during the last twenty years, primarily in theoretical studies.* There is, however, a lack of scientific testing and verification of these theories which would consider all these areas while stressing the need to concentrate on what is happening perceptually, compositionally, and aesthetically within the boundaries of a television screen.

What is being suggested here is the following:

First, the study of the structure of television images should be based on experimental research in visual perception. We need to be reminded, perhaps more now than ever before, that the visual world differs in many respects

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*The works of: (a) J. J. Gibson (1950, The Perception of The Visual World, 1954, "A Theory of Pictorial Perception," (b) R. Arnheim (1969, Art and Visual Perception, 1972, Visual Thinking), (c) R. H. McKim (1972, Experiences in Visual Thinking), (d) E. H. Gombrich (1969, "The Visual Image"), (e) D. A. Dondis (1973, A Primer of Visual Literacy), (f) J. M. Kennedy (1972, A Psychology of Picture Perception), (g) H. Zettl (1973, Sight, Sound, Motion: Applied Media Aesthetics), and (h) E. B. Goldstein (1975, "The Perception of Multiple Images").

from the visual field. Objects and subjects which appear in the visual field are not the same as when they appear in the visual world. Not only do they loose dimensionality and take on a new perspective, but, more importantly, they take on a new meaning.

Second, the study of the structure of visual images, and particularly moving images, should be based on the study of each of the basic elements of visual communication. For example, Kandiski (1947) used this process in painting. He built up structures using the basic elements of painting-ranging from points, to lines, to planes, to colors. We can use the same process to structure moving images working inductively with the elements of light, color, shape, movement, editing, sound, etc. Perhaps what Dondis (1973, pp. 39-60) suggests is even more appropriate:

> The visual elements are the basic substance of what we see, and they are few in number: the dot, line, shape, direction, tone, color, texture, dimension, scale, movement. Few though they may be, they comprise the raw material of all visual information in selective choices and combinations. The structure of the visual work is the force that determines which visual elements are present and with what emphasis.

Third, the study of the structure of moving images should be based upon extensive observation, control and measurement of each separate force which operates within the concentrated space, the confined area of the film or television screen, and upon all these forces or factors combined. Such forces, according to Zettl (1973), Dondis

(1973), Murch (1973), Arnheim (1969), Millerson (1961), and others are: (a) magnetism of the frame, (b) attraction of mass, (c) figure-ground relationship, (d) psychological closure, (e) vectors, and (f) asymmetry of the frame.

Henceforth, this paper will discuss the field forces theory, provide the spatial characteristics of the picture field, and state the various forces that operate within the frame while posing questions which will aid in the scientific measurement of these forces.

FIELD FORCES THEORY

Investigation of the processes involved in the perception of visual messages has led to the establishment of a visual force theory which deals with the way objects of the "visual world" are perceived when they are reconstructed and presented in the "visual field." The concentrated space of a theatrical stage, a painting, a photograph, a film or television screen is defined as a visual field. Studies of the structural and perceptual properties that characterize the visual field have lead to the establishment of the field forces theory.

Gibson identifies distinct differences in perception of objects that exist in the "visual world," compared with those that appear within the "visual field." According to Gibson (1950, p. 164):

> The visual world . . . differs from the visual field in a number of ways. First, it has depth or distance, and it includes the experience of solid objects which lie behind one another. Second, it is Euclidean in the sense that neither the objects nor the spaces between them appear to change their dimensions in perception when the observer moves about. This is a general way of saying that they tend to remain constant. Third, it is stable and upright; things as seen have constant directions-from-here when the observer tilts his head. Fourth, it is unbounded; our experience of the world does not have any visible margins or limits such as the visual field of a picture has. Finally, it has a characteristic to which we have scarcely referred but which, in a way, is the most important of all; it is composed of phenomenal things which have meaning.

Arnheim (1969, pp. 213-391) and Zettl (1973, pp. 100-221) have identified internal characteristics or forces that operate within the boundaries of a picture. Both Arnheim and Zettl divide these field forces into "latent forces" and "active forces." Latent forces are those hidden structural or spatial forces which, like a magnetic field, act upon objects within the frame. Intuitively or otherwise, we detect the existance of these hidden forces when we compose visual elements within the concentrated field. Arnheim (1969, pp. 1-11) suggests that the discomfort caused by a disc located off center in a square is due to some hidden structural factors which tell us that the disc is off center. The concentrated field, Arnheim arques, exerts magnetic structural forces which direct us to correct the placement of the disc and place it in the center of the bounded square. Active forces are defined by the

concentrated field itself. When no objects exist within the field, it is neutral. Only when objects are placed within the frame do structural forces start operating.

The field forces theory can be summarized in the words of Zettl (1973, p. 100):

> The screen provides us with a new, concentrated living space, a new field for aesthetic expression. It helps us to tame space. We are no longer dealing with the real space we walk through and live in every day, but rather with the screen space. We must now clarify and intensify experience within the context of screen space. Not what we might see, but what the camera sees becomes of primary importance.

THE SPATIAL CHARACTERISTICS OF THE PICTURE FIELD

All visual communication media produce images that comply with the following spatial characteristics - orientation, aspect ratio, and size (Zettl, 1973, pp. 120-147), which are external, and main direction, proportion and balance, which are internal.

External Spatial Characteristics

An event described by a television picture commonly occurs during a defined time in a specific place. The first task of the television picture should be to orient the viewer in time and space. The television screen is horizontally oriented. That means that most visual elements within the screen primarily move from side to side since we have been accustomed to a horizontal orientation rather than a vertical one. We live, move and perceive on

horizontal plane rather than a vertical one (Murch, 1973, pp. 167-169).

Another important characteristic of the picture field which seems to have definite perceptual, compositional and aesthetic implications, is the standardized 3:4 aspect ratio. Perceptual psychologists such as Gibson (1950), Murch (1973) and Goldstein (1975) have found that "The visual field [for both eyes] extends about 180 degrees laterally and 150 degrees vertically." This is roughly the 3:4 aspect ratio which is standard in television sets. Both Millerson (1966, pp. 196-199) and Zettl (1973, pp. 120-127) agree that this ratio is considered to give an ideally proportionate picture field which permits an easy framing of images in motion.

The third spatial characteristic of the picture field is its size. It has been suggested that the small size of the televivision screen has a definite aesthetic potential and communicative power which differs from that of the large screen. Millerson (1966, pp. 200-202), Zettl, (1973, pp. 110-116), and Tarroni (1968, pp. 53-62) discuss the perceptual, compositional, and aesthetic implications of the small visual field versus the large one in respect to their sizes.

Internal Spatial Characteristics

Within the borders of any clearly defined space such as the frame of a painting, the opening of a stage,

the movie or television screen, there operate three major compositional principles (internal spatial characteristics) that explain the arrangement of the visual elements within the frame. These are (a) the main direction, (b) the proportions, and (c) the balance of the visual messages.

The visual messages should provide a specific direction whether horizontal or vertical, left to right, right to left, up to down, etc. If a visual message, an event occuring within the visual field, is to be effective, it should clearly direct the flow of action for the viewer to follow. The establishment of the main direction, sometimes called continuity, is one of the principle spatial characteristics of the concentrated field.

An equally important characteristic of the visual field, and a compositional principle that applies to all visual communication messages, is proportion. Proportion is defined as the compositional principle dealing with the relationships of measureable spatial dimensions and consists of two types: (1) symmetrical proportions, where all the measureable spatial dimensions are equally distributed within the frame, and (2) asymmetrical proportions where these elements are not symmetrically or equally distributed within the frame. McKim (1972, pp. 66-67) recognizes two different types of proportions which he calls "functional" and "aesthetic."

> Functional proportions, unlike aesthetic proportion, is usually reducible to numbers. The structural function of a beam, for example, is related to the numerical ratio of its demensions; the useful function of a chair is related to the measured height of the seat above the floor.
>
> Aesthetic proportion, the harmonious visual relationship of parts to the whole, is essentially qualitative despite many attempts to bring aesthetic proportion into the quantitative realm. The ancient Greeks, for example, used geometrically derived golden-section rectangles to design the proportions of the Parthenon.

Balance is defined as the relationship of non-measureable pictorial, and sometimes other, elements within the screen. According to Arnheim (1969, pp. 1-32), balance is the state of distribution of non-measureable pictorial elements when they come to a stand-still state. And according to Zettl (1972, pp. 169-171), balance is the state of distribution in which the graphic energy equalizes the elements of the moving image so that a continuing comfort is achieved. Balance can be either stable, unstable, or neutral.

FORCES THAT OPERATE WITHIN THE FRAME

Asymmetry of the Screen

The development of the theory known as asymmetry of the screen (as a primary force operating within the screen) is attributed to the works of Millerson (1966), Arnheim (1969), Dondis (1973), and Zettl (1973). It comes as an extention and modification of the asymmetry of the frame theory. It includes the element of motion as found

in film and television and states that a picture is asymmetrically structured when the visual elements, sometimes called "graphic elements" (Zettl, 1973) or "basic elements of visual communication" (Dondis, 1973) are unequally distributed within the screen creating a visual imbalance that favors one side of the picture over the other.

Although scholars have agreed that the left side of a visual field is perceived differently than the right (Bartley, 1972, pp. 245-249), the argument as to which side is more attractive and preferable to the viewer has not been resolved. This author, in his dissertation study, explored this problem.

Neurological studies have suggested that the right hemisphere of the brain is specialized in "holistic mentation," and determines our orientation in space, artistic endeavor, crafts, body image, recognition of faces; whereas, the left hemisphere of the brain is predominantly involved with analytic, logical thinking, especially in verbal and mathematical functions.

The following questions identified the problem of this study:

1. Does placement of visual elements on the right or left side of the television screen differentially affect viewers' perception of the weight, importance, prominence, attractiveness and interest value of the visual field?

2. Does placement of visual elements on the right or left side of the television screen differentially affect the retention of verbal content?
3. Does placement of visual elements on the right or left side of the television screen differentially affect the retention of visual content?

One hundred and forty-eight (148) subjects were randomly assigned to four treatment groups. Each treatment group (n=37) independently viewed one of four newscasts where visuals (illustrating the content of twenty news stories) appeared on the right (Treatment #1), on the left (Treatment #2), on the left and right (Treatment #3), or on the right and left (Treatment #4). The newscaster appeared on the opposite side of the screen.

Three types of measures were constructed to test for treatment affects:

1. Likert-type scales were used to measure viewers' perceptions of the weight, importance, prominence, attractiveness and interest value of the visual field.
2. A multiple-choice test was used to measure retention of verbal content presented in the newscast.
3. A visual retention test was used to measure the degree to which the visuals used in the newscast were correctly identified.

The data were analyzed by one-way analyses of variance. Appropriate post-hoc analyses were made on data which yielded a significant F-ratio. Tests for significance were made at the .05 level of confidence.

The following conclusions were reached from the results of this study:

1. Perceived weight, importance, prominence, attractiveness and interest value are not affected by placement of visual elements on the left or right side of the television screen.
2. Retention of verbal content from a newscast is not affected by the placement of visual elements on the left or right side of the television screen as long as these visuals do not illustrate specific factual information such as numbers or dates.
3. In a newscast where the left and right portions of the television screen are equally shared by newscaster and visuals depicting the content of the news stories, retention of the visuals is somewhat enhanced by their placement on the left side of the television screen. Common factors which may be related to the asymmetry of the screen theory are relative size, color, form, vectors and contours of the visual materials.

Magnetism of the Frame

Zettl (1973, p. 121) has theorized that:

> The frame of a picture field, the edges of the screen, exert a strong pull on objects near them. Especially the corners (where the forces of the two main directions, height and width converge) attract near objects with great force.

Although intuitively we tend to frame TV pictures within the borders of the screen, the appropriate distance of visuals from the screen's borders has not been established and the perceptual, compositional and aesthetic reasons for the magnetism of the frame phenomenon have not been explained scientifically.

A test of this theory is possible through the construction of appropriate visual stimuli that will keep certain conditions constant, and an experimental design that will identify the variables involved.

An important question that would identify the problem of magnetism of the frame is:

> Does placement of visual materials, graphic elements, on the extreme (a) top, (b) bottom, (c) right, (d) left edges of the television screen differentially affect viewers' perception of their visual content?

Attraction of Mass

It is a law in physics that mass attracts mass. Zettl (1973, p. 121) theorizes that such a law is also applicable to screen images which are called graphic mass, and it is very important to the study of the structure of television images.

Arnheim (1972, pp. 54-79) discusses this principle in terms of dependency of objects appearing in the visual field, and Duncker (1960, pp. 161-172) points out that in the visual field, objects are seen in a hierarchical relationship of dependence. The houses are attached to the hill, not the hill to the houses. The large objects within the screen serve as the independent units while the small ones are the dependent ones.

As in the case of magnetism of the frame discussed previously, the phenomenon of attraction of mass is an empirical observation which needs to be tested and measured because of its perceptual, compositional and aesthetic implications.

Careful construction of visual stimuli that will control the variables involved, and an appropriate experimental design that will consider measureing a series of independent variables simultaneously are warranted.

A possible question that would identify the problem of the attraction of mass theory in television images reads:

> Does placement of extremely unequal (in size and mass only) visual elements within the television screen differentially affect the viewers' perception of their interdependency?

Figure-Ground

According to Murch (1973, p. 65):

> That some potential stimuli become effective while others remain ineffective is easily observed. The task of identifying the attributes of the former proves more difficult. Nevertheless, one rather obvious attribute is that effective stimuli appear to stand out against the background of potential stimuli. Such stimuli become figures, whereas the other stimuli provide a packground.

Within the concentrated field, the television screen, we perceive the figures, the images, in front of a continuous background, the screen, as though they belong to the ground created by the screen. In order for a stimulus, an image, to convey information about the environment, it has to be clearly differentiated from it. Often such differentiation is neglected and information, through images, becomes ambiguous.

For the study of the structure of TV images, the figure-ground differentiation and segregation as a phenomenon that occurs within the visual field is extremely important.

The problem and the hypothesis concerning the measuring and testing of the figure-ground segregation theory could be stated as follows:

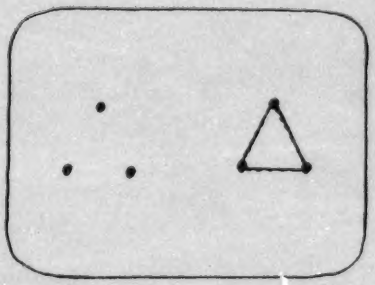
> Does orderly placement of visual materials within the television screen differentially affect viewers' perception of figure-ground relationships?

Psychological Closure - Gestalt

A crucial factor in the structure of television and film pictures and one of the most important forces which operate within the visual field is the principle of psychological closure.

The perceptual process by which we take a minimum amount of visual or auditory cues and mentally fill-in non-existing information in order to arrive at an easily manageable pattern, is know as psychological closure (Zettl, 1973, p. 135). The new structure created through this process, this mental organization of closure, is called gestalt (Murch, 1973, pp. 130-137, Zettl, 1973, p. 135).

In the picture below, for example, the three dots are perceptually organized to form the geometric figure of the triangle.



According to Zettl (1973, pp. 135-138), "A gestalt is not simply the sum of its elements, but more so, it consumes its elements into a larger whole." In the case of the triangle above, each dot fulfills a vital gestalt function.

Should any one of the three dots be missing, we would not be able to "organize" the triangle, the gestalt. We need a minimum amount of information, visual or auditory, in order to be able to arrive at a figure, a pattern, a shape, etc.

Arnheim (1969, p. 44) points out that it is through perceptual organization that we try to see any stimulus pattern in such a way that the resulted structures which we have organized into meaningful patterns, are as simple and stable as possible.

Zettl (1973, p. 137) theorizes that:

> The low-density (possessing relatively small amount of visual information due to limtied number of scanning lines) television picture relies quite heavily on our facility for psychological closure. Although our persistence of vision ("seeing" something for a short period after it has already been removed from our vision) helps us to perceive the scanning dot of the TV image as a complete image, we need to apply psychological closure to relate the low-information patterns on the screen into meaningful visual images.

The gestalt factors of perceptual organization listed by Murch (1973, pp. 132-137) are: (a) the factor of similarity, (b) the factor of proximity, (c) the factor of common fate, (d) the factor of objective set, (e) the factor of inclussiveness, (f) the factor of good continuation, (g) the factor of closure, (h) the factor of fixation, (i) the factor of contour, and (j) the factor of interdependence. All these factors occur at one time or another when we structure images in the visual field. Their study, control and measure is warranted.

Collectively the problems and the hypotheses dealing with the testing of the theory of psychological closure and gestalt can be stated as follows:

> Does placement of minimal graphic elements within the television screen differentially affect viewers' perception of organizational patterns given the factors of similarity, proximity, common fate, objective set, inclusiveness, good continuation, closure, fixation, contour, and interdependence?

A multi-dimensional design which will consider all these factors simultaneously is more appropriate in this case, and a suitable multi-variance statistic is warranted.

Vectors

The strongest force operating within the screen which is indispensable to the structure of visual images is the force caused by directional lines that lead the viewers' eyes from one point to another. Such directional lines are called vectors. Zettl (1973, p. 140) defines vectors as "a force with a direction and a magnitude," and relates Andrew Paul Ushenko's (1953, pp. 60-119) theory of physical vectors to perceptual vectors created by moving elements within the TV screen.

Since there are numerous vectors which interact to compose the moving image, Zettl (1973, p. 140) calls the television screen a "vector's field." In film and television

where we deal with actual motion of images within the screen, the concept of vectors is probably the single most important aesthetic factor.

Depending upon their ability to direct the eye from one point to another, Zettl (1973, p. 140) recognizes three types of vectors; (a) graphic vectors are created by stationary visual elements such as buildings, telephone poles, etc., arranged so that they lead the eye into a particular direction; (b) index vectors are defined as the directional forces created by an object which points unquestionably towards a specific direction such as a finger pointing, a sign, etc.; (c) motion vectors are created by someone or something actually moving in a particular direction such as a person walking, a car moving, a skier coming down the slopes, etc.

Distinguishing the vector's strength and magnitude, Zettl (1973, p. 142) states that the graphic vectors are less strong than the index ones, which, in turn, are weaker than the motion vectors. The magnitude of a vector indicates the degree of its directional force. A vector of high magnitude exerts a strong directional force; it leads our eyes unquestionably into a specific direction, and you have the feeling that it does so with considerable force. Examples are a train racing along a straight track, a rocket going up, a football player racing across the field. All produce strong motion vectors.

Although motion vectors have a higher magnitude than the index vectors, and index vectors are stronger than the graphic vectors, the magnitude of a motion vector depends on the speed of the object. Thus, a slowly moving object produces a vector of a lower magnitude than a fast moving object. Insofar as their main direction is concerned, vectors are either continuing (succeeding one another), or converging (one going against the other).

The knowledge of the vector field and the interaction of the vectors is helpful and a necessary tool for the television director. The scientific measurement of the theory of vectors is complicated since each and every one needs to be measured simultaneously and/or separately.

Collectively, the problems and the hypotheses concerning the varification of the vectors theory could be stated as follows:

> Does placement of visual elements within the television screen differentially affect viewers' perception of (a) graphic, (b) index, (c) motion, (d) continuing, and (e) converging vectors?

Again, a multi-dimensional design and a multivariance statistic are required for the testing of the hypotheses refering to the phenomenon of vectors.

GENERALIZATIONS

What I have tried to suggest here is the study of the structure of television images based on the field forces theories that have been developed by scholars in (a) perceptual psychology, (b) visual composition, and (c) aesthetics of the moving image.

Although individual efforts have been made towards this direction, and the forces operating within the visual field have been theorized, experimental studies which will test these theories are scarce.

I am suggesting that such studies will not only enhance our knowledge of staging for television, but also, will set forth the scientific approach to the study of the television medium.

So far, we have made observations and we have theorized extensively about the major components of the medium. We have dealt with light, color, and have theorized about the various lighting techniques. We have discussed and experimented with television staging and space manipulation on a practical, learning by doing basis. We have observed, and theorized about the use of motion, timing and editing for television. Lastly, we developed various theories about the role of sound in television.

Few, if any at all, of these theories have been tested or varified scientifically. We must start measuring

these theories, qualitatively if we are to establish solid ground upon which the study of the structure of television pictures should be built.

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